

STUDY OF THE INCIDENCE OF PATHOGENS AND THEIR DRUG SUSCEPTIBILITY PATTERN AMONG UTI PATIENTS IN BANGLADESH

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ABSTRACT

This retrospective study was conducted from July to September, 2013 with a view to find out incidence of UTI patients with aiming to testing antimicrobial drug susceptibility. In order to conduct this study, consecutive urine samples of 614 of total population of both sexes and various age groups were taken in a hospital setting of both outdoor and indoor patients. There was marked gender variations in all age groups, which comprised 0-85 years of age of the member of urine sample requested for examination. Only 20.03% of specimens yielded positive culture. UTI was found more prevalent in female than in male. The most common isolates in the Gram negative organisms were *E. coli* (46.34%) followed by *Klebsiella* sp. (13%) and *Candida* sp. (10.56%). In the Gram positive group, non hemolytic *Streptococci* comprised 8.94%. Prevalence of UTI cases was caused by 85% of Gram negative and 15% of Grams positive organisms. The study also reveals that patients of UTI cases were associated with abnormal count of pus cells, albumin and sugar. In this study the organisms are resistant to common antibiotics (Cotrimoxazole, Nitrofurantion, Nalidixic Acid). *E. coli* were found sensitive to Colistin (Polimyxin E) and Carbapenem ranging from 82-89% followed by Amikacin and Nitrofurantion from 63-72%. On the other hand highly resistance was revealed against Cefepime and Nalidixic acid from 63-72%.

KEYWORDS: UTI Patients, Drug Susceptibility, Pathogen

INTRODUCTION

A urinary tract infection (UTI) (also known as acute cystitis or bladder infection) is an infection that affects part of the urinary tract. When it affects the lower urinary tract it is known as a simple cystitis (a bladder infection) and when it affects the upper urinary tract it is known as pyelonephritis (a kidney infection) (Raynor and Carson 2011). The main causal agent of both types is *Escherichia coli*, however other bacteria, viruses or fungi may rarely be the cause. Urinary tract infections occur more commonly in women than men, with half of women having at least one infection at some point in their lives. Risk factors include female anatomy, sexual intercourse and family history. Pyelonephritis, if it occurs, usually follows a bladder infection but may also result from a blood borne infection (Salvatore *et al* 2011). In those with vague symptoms, diagnosis can be difficult because bacteria may be present without there being an infection. In complicated cases or if treatment has failed, a urine culture may be useful. In uncomplicated cases, urinary tract infections are easily treated with a short course of antibiotics, although resistance to many of the antibiotics used to treat this condition is increasing. In complicated cases, longer course or intravenous antibiotics may be needed, and if symptoms have not improved in two or three days, further diagnostic testing is needed.

In women, urinary tract infections are the most common form of bacterial infection with 10% developing urinary tract infections yearly. Urinary tract infection (UTI) is the third most common infection experienced by humans after

respiratory and gastro-intestinal infections. It has been estimated that about six million patients visit out patient departments and about 300,000 are treated in the wards every year for UTI worldwide (Bhat *et al* 2011). With the constantly shifting trends in drug resistance, antibiotic options, and multiplying microorganisms, UTI implies both microbial colonization of the urine and invasion of the lower or upper urinary tract by microorganisms (Colgan and Williams 2011). Count as low as 1000/ ml of any single bacterial type or as few as 100/ml of coliforms such as *E. coli*, are now considered an indication of significant infection, especially if leukocytes appear in the urine (Amdekar *et al* 2011).

Microorganisms that cause UTIs almost come from the skin at or near the opening of the urethra. Gram negative bacteria cause 80-85% where as Gram positives cause 15-20% of the cases. Common Gram-negative species include *E. coli*, *Klebsiella*, *Proteus*, *Enterobacter*, *Pseudomonas*, and *Serratia* spp. and Gram-positive organisms, including group B *Streptococci*, *Enterococcus* sp. and *Staphylococcus aureus* and *Staphylococcus saprophyticus* have also been frequently isolated (Amdekar *et al* 2011; Nicolle 2001; Gould *et al* 2010; Colgan and Williams 2011). In children approximately 5% of girls and 1% of boys have a UTI by 11 years of age, in the neonates is 0.01-1% and can also be as high as 10% in low birth weight and preterm babies (Foxman 2003; Gould *et al* 2010; Amdekar *et al* 2011; Gupta *et al.*, 1999; Colgan and Williams 2011).

An extensive body of clinical research confirms that the fluoroquinolones are extremely effective for the treatment of UTIs ranging in severity from uncomplicated cystitis to urosepsis. The superiority of ciprofloxacin compared to trimethoprim-sulfamethoxazole has also been confirmed in patients with acute pyelonephritis. The Ampicillin and Nitrofurantion have also been recommended to treat UTIs in routine (Bhat *et al* 2011, Gould *et al* 2010, Eves and Rivera 2010). The present study was aimed at evaluation of the patterns of antibiotics sensitivity against uropathogens in different group ages of both genders and the incidence of UTI patients with antimicrobial drug susceptibility; specifically to isolate and identify the causative agents of urine infections.

MATERIALS AND METHODS

This is a prospective study and has been carried out in the United Hospital Limited, Bangladesh. All the specimens were collected from hospital attending patient of United Hospital Limited. The duration of the study was a period of 3 months from July to September 2013. All samples were collected from OPD and IPD patients of United Hospital Limited, having clinical symptoms of microbial infection. Samples were collected from both sexes and different age groups. The total number of respondents in the sample was 614. The specimen types that included in this study were urine. Several culture media were used in this study. These are Mac Conkey,s Agar, Mueller Hinton and Blood agar. The urine specimens (10µl) were immediately inoculated unto Mac Conkey agar, Blood agar media by the platinum loop as soon as possible. Then the plates were incubated at 37⁰C for 24-48 hours and observed the plates the next day. For the culture of urine sample 3 types of media were used- Blood agar for isolation of pathogenic gram positive and gram negative bacteria (Mostly used for *Streptococcus*), MacConkey agar for isolation of only gram negative or Enterobacteriaceae and Mueller-Hinton agar media for antibiotic susceptibility test.

All the suspected colonies were subjected to Gram staining for initial identification of organisms according to their Gram reaction and morphology. In this study, all the biochemical tests were done by following standard methods. Following the incubation, colonies from the different media were characterized and identified using standard microbiological and biochemical scheme. The tests included gram and spore test, catalase test and oxidase test. Coagulase test was done for confirmation of *Staphylococcus* sp. in the catalase test positive. Suspected Gram-Negative organisms

were identified by colony characteristics and Microgen test procedure (a biochemical identification system for the common Enterobacteriaceae) (Woodford and George 2011). Dipstick Method was done for chemical analysis of Urine (Takhar 2011).

RESULTS AND DISCUSSIONS

A total 614 patients of UTI of either sex with the respective ratio of 39:59 (Male: Female) between age group of 1-90 years were studied (Figure 1). This is apparent from the result that the reason to get 20.03 % positive culture having bacterial etiology. The following histogram shows the number of UTI suspected cases according to different age group where higher UTI suspected age group are 21 to 30. It was found that 123 UTI positive patients of 614 suspected cases among them 52 from OPD and 71 from IPD patients. It can be deduce from this experiment that the most common isolate was *E. coli* (46.34%), followed by *Klebsiella* sp (13%) and *Candida* sp (10.56%).

The present results indicate the *E. coli* is the principal etiological agent of UTI (Figure 2). In this study Gram Negative and Gram Positive organisms are responsible for 85.45% and 14.55% UTI respectively. It can be surmised from this study that the most common isolate from male patient was *E. coli* (17.54%), followed by *Klebsiella* sp. (27.27%) and *Candida* sp. (38.46). It was observed that the percentage distribution of etiological agents that the most common isolate in female patient was *E. coli*, followed by *Klebsiella* sp. and *Candida* sp.

It was observed that the *Providencia* sp. and *Acinetobacter baumannii* are higher in male than female (Figure 3) which was also found by Schaeffer and Dielubanza (2011). The distribution of abnormal finding in urine such as pus cell, albumin and sugar were also analyzed in present study (Table 1) where Pus cell (71.54%), Albumin (54.47%) and Glucose (13.82%). This study indicates that pus cell is principal abnormal findings in urine for UTI patients. The antibiotic sensitivity test was performed for bacterial isolates only.

In this study it is indicate that total isolate showed highest sensitivity (72%) to Amikacin and low susceptibility (17%) to Nalidixic acid. Gram positive bacteria showed highest sensitivity (72%) to Linuzolid and Vancomycin; whereas low susceptibility (12%) to Ciprofloxacin. Gram negative bacteria showed highest sensitivity (79%) to Amikacin and low susceptibility (33%) to Ciprofloxacin & Cotrimoxazole (Figure 4).

It has also been reported as previously that Amikacin was the most effective antibiotic against *E. coli* (Schaeffer and Dielubanza 2011) while nalidixic acid showed 23% sensitivity against this pathogen (Amdekar *et al* 2011, Nicolle 2008) the results were not supported by another study where the susceptibility rate of *E. coli* to Amikacin remained 93-100% (Eves and Rivera 2010).

The highest sensitivity of *K. pneumoniae* observed was 93% to Colistin and low susceptibility 18% to Netilmicin which were all most similar by the previous findings (Nicolle 2008, Bhat *et al* 2011). Gram negative uropathogen *Pseudomonas* sp showed highest sensitivity (81%) to Tazobactam and low susceptibility (9%) to Amoxyclave.

Identification of the etiological agents and its susceptibility to antimicrobial is important, so that proper drug is chosen to treat the patient in early stage of UTI. It is therefore recommended that routine microbiological analysis and antibiotic sensitivity test of mid stream urine samples of patients be carried out before the treatment in the management of UTI (Popescu *et al* 2009).

This present study shows that the susceptibility pattern of different organisms has changed to great extent. Commonly most organisms of UTI were found resistant to Penicillin, Cotrimoxazole, netilmicin, Gentamycin,

Erythromycin and Ciprofloxacin. This study suggests that now mostly the higher group of antibiotics namely Amikacin, Ceftazidime, cefepime, Cefixime, Meropenem, Imipenem are now effective for gram negative organisms of UTI.

In some cases there is emergence of multi drug resistant (MDR) organisms which are resistant to all kinds of antibiotics. For these MDR organisms now only intra venous use of Colistin is given. But most of these drugs are again nephrotoxic. Of all the Polymyxin only Polymyxin E (Colistin) which is less Nephrotoxic is now given intravenously for MDR *E. coli* and *Klebsiella*. The gram positive organisms are also now resistant to most of the antibiotics except Vancomycin and Linezolid. This phenomenon has arisen due to indiscriminate use of antibiotics. In this study, it was concluded that the incidence of disease is higher in females than male and incidence of infection was much higher in the patient between 51-60 years of age as compared to other age group.

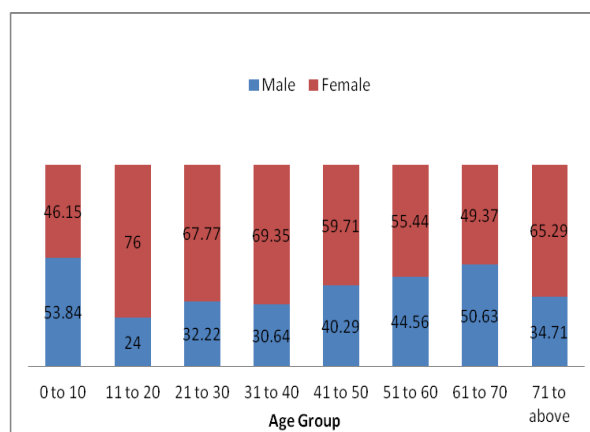


Figure 1: Distribution of Cases among Different Age Group

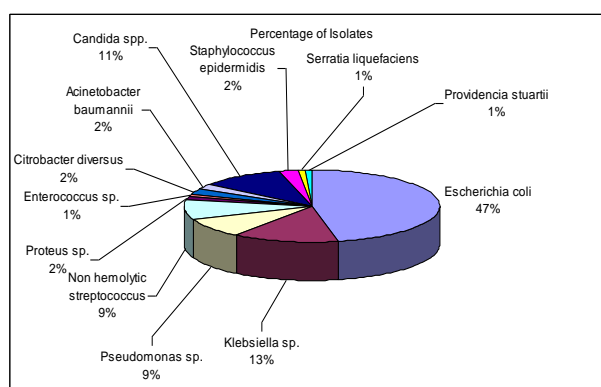


Figure 2: Percentage of UTI Isolate Pathogen

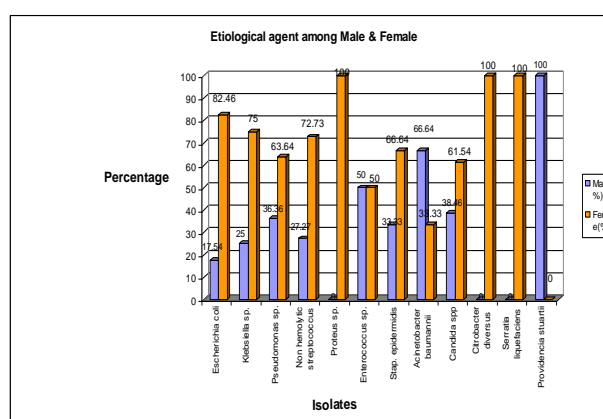
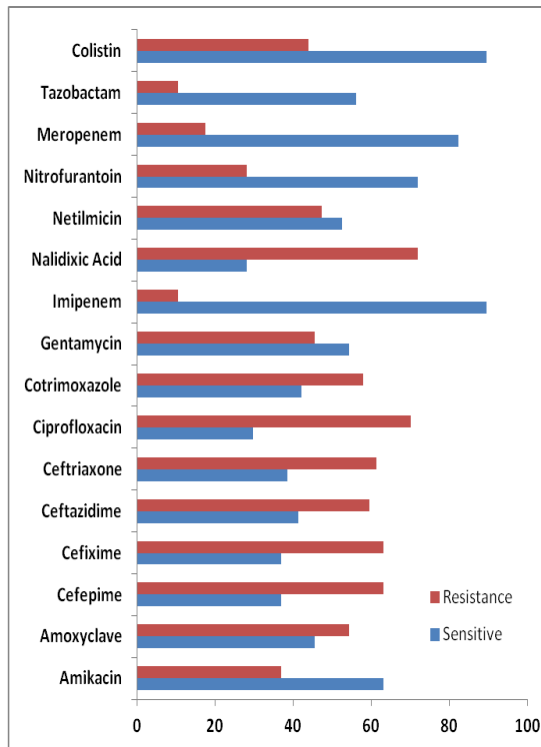
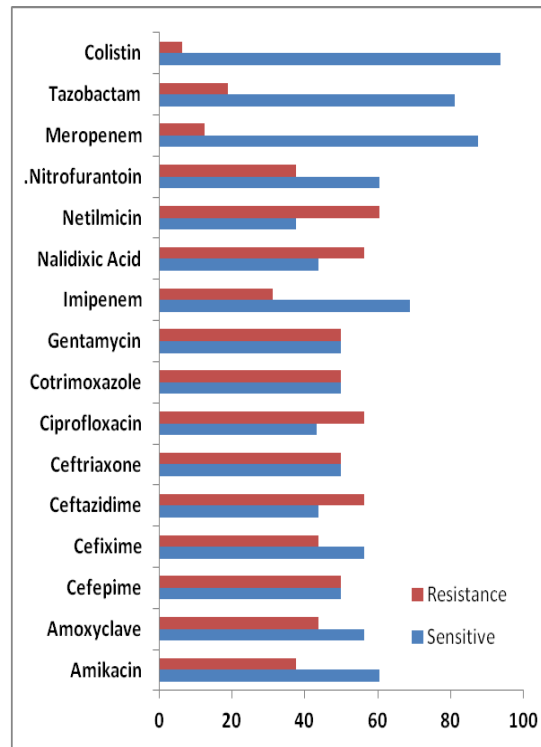
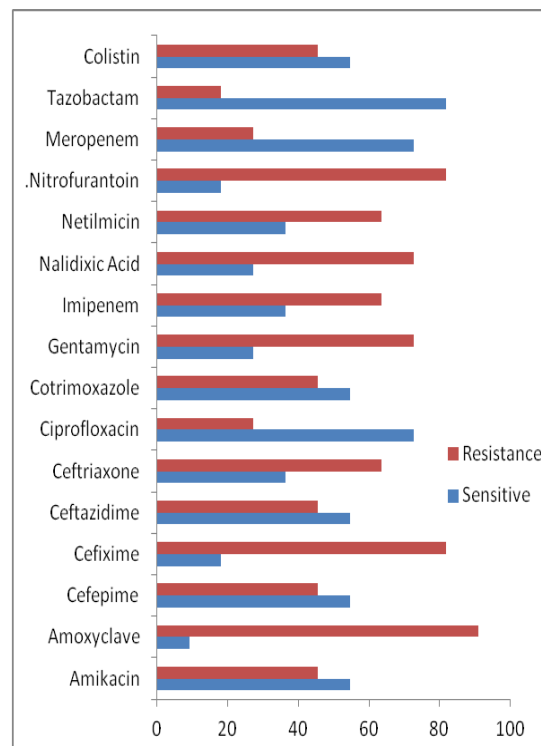
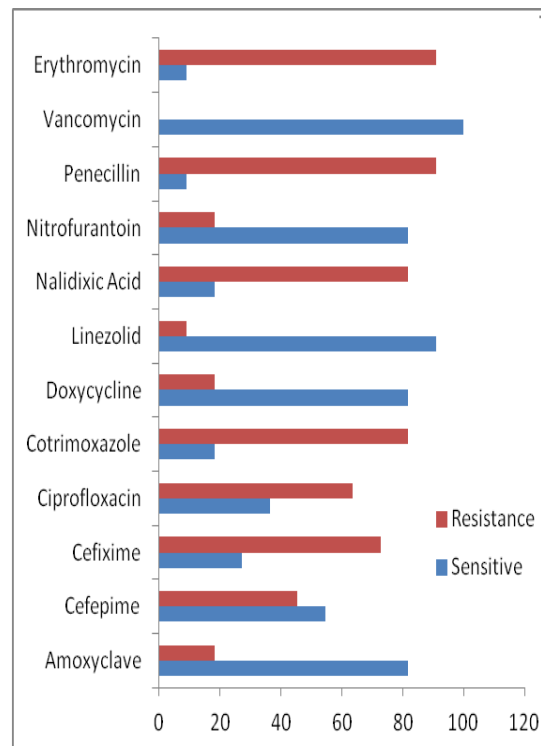
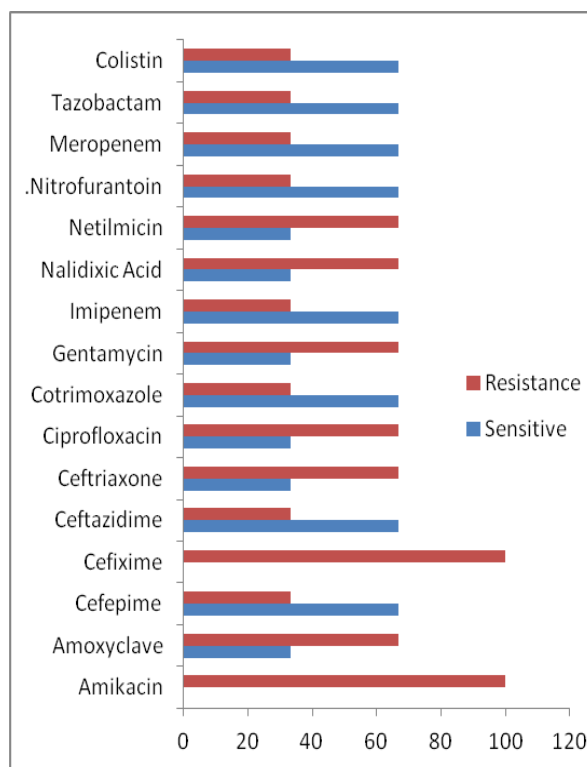


Figure 3: Percentage of Etiological Agent among Male and Female

Table 1: Specific Abnormal of Presence of Pus Cell, Albumin, Sugar in Urine of UTI Patients

Name of Urine Analyte	Total Positive Case (%)	Male (%)	Female (%)
Pus cell >10HPF	71.54	27.27	72.73
Albumin(+) or above	54.47	32.84	67.16
Glucose	13.82	41.18	58.82

**(A) *E. coli*****(B) *Klebsiella sp.*****(C) *Pseudomonas sp.*****(D) *Nonhemolytic Streptococcus***

(E) *Acinetobacter* sp.**Figure 4: Antibiotic Sensitivity Pattern of Different Isolates from UTI Samples**

CONCLUSIONS

This study aimed to ascertain the current situation of Urinary Tract Infections (UTIs) and drug resistance in different age groups of patients in Bangladesh. In this study, it was concluded that the incidence of disease is higher in females than male and incidence of infection was much higher in the patient between 51-60 years of age as compared to other age group which reveal that UTI can affect anyone at any age. Urinary tract infection is usually caused by gram-negative bacteria, particularly califorms. In present study, prevalence of UTI cases was 85% in Gram negative and 15% in Grams positive organisms and the most common isolates in Gram negative were *E. coli* followed by *Klebsiella* sp. whereas in Gram positive group, non hemolytic *Streptococci* comprised 8.94%. Bacteria affects all parts of urinary tract which consist of ureters, bladder, kidney, urethra and prostate in man through infection. Bacteria get in to urinary tract and infect single or multiple parts of it and thus, cause a urinary tract infection. “Cystitis” is the term used for bladder infection and pyelonephritis is known as kidney infection. Infections at these various sites may take place simultaneously or separately and may either be asymptomatic which means clear symptoms for infection is absent or be there as one of the clinical syndromes. The study also reveals that patients of UTI cases were associated with abnormal count of pus cells, albumin and sugar. In this study the organisms are resistant to common antibiotics (Cotrimoxazole, Nitrofurantion, Nalidixic Acid). *E. coli* were found sensitive to Colistin (Polimyxin E) and Carbepenem ranging from 82-89% followed by Amikacin and Nitrfurantion from 63-72%. On the other hand highly resistance was revealed against Cefepime and Nalidixic acid from 63-72%.

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